PATENT SPECIFICATION

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COMPLETE SPECIFICATION

Contact or Runway Light

We, McGRAW ELECTRIC COMPANY, a corporation organized and existing under the laws of the State of Delaware, United States of America, of 120, South La Salle Street, Chicago, Illinois, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to light projectors, and especially pertains to contact or runway marker lights for use on airports and the like to facilitate landing and takeoff operations of aircraft.

Experience has proven that in addition to instrument approach systems, traffic control, radio approach and other flying aids, an adequate ground approach and runway lighting system is most essential to assist aircraft pilots to land their planes safely under low visibility conditions caused by fog, snow, rain, smoke, and dust during either daytime or nighttime operations. Instrument and radio pilotage equipment is very effective in aiding the modern aircraft to be taken off from fields where there is little ceiling and visibility, and continuing its journey directly and safely to distant points assisted only by radio-range equipped airways.

It is common knowledge that the penetration of fog is entirely a function of candlepower, and lights used in an airport lighting system to combat low-visibility conditions must be so designed and controlled that at no time during the landing will any beam of light fall on the eye of the pilot in such degree as to impair the eye's maximum efficiency. Usable light is, therefore, a factor of point candlepower versus background brightness. A point source of light of relatively low candlepower concentrated and directed by proper control can be made more visible and useful than a standard type of non-controlled runway light of a much greater candlepower. Applying this principle to an airport landing light system, where the point of observation is always in a vertical plane down the center of the approaching runway, all contact or runway lights must be designed and controlled so that when any light from the unit reaches any point in the vertical plane, it must have a predetermined uniform value at such point of intersection.

Continued studies and operating practice brought forth the introduction of controlled-beam runway light projectors for providing a glare-free signal to approaching aircraft under even the most adverse weather conditions. These units comprised a lamp and lens system which provided an extremely accurate control of the light beam. A set of these lights installed parallel with one another along both sides of the approach path and runway could be adjusted and controlled to provide correct brightness to the pilot when landing or taking off. Operation of the controlled unit is based on a fundamental accepted formula, such as Allard's Law. In essence, Allard's Law provides that when a light just visible in an obstructing atmosphere, such as fog, is being observed and an uncontrolled light is placed between it and the observer, the light farther away becomes invisible because the light reflected off the atmosphere particles around the nearer light becomes brighter than the light emanating from the more distant source. The halo in fog is caused by light shining on the fog at an angle to the direct line of vision and of such intensity that it is reflected off, or refracted, by the drops of moisture making them visible. When the distribution and intensity of the light source are controlled so that only direct light (with just sufficient candlepower) penetrates to the point of observation, the light appears as a point source and the halo, or fogging, of the atmosphere about it is kept to minimum. Correct beam control minimizes the possibility of a "glare barrage."

Under the controlled system with relatively clear atmospheric conditions, the main light path is projected substantially parallel to the runway at relatively low intensity. Obviously,

[Price 3s. 6d.]

under restricted visibility the light envelope shrinks with the penetration of the higher candlepower beams being reduced more than that of the lower candlepower beams, according to Allard's Law. Therefore, the effective areas fall away from the center line of the runway. Merely increasing the output of the lamp does not restore the path of equal brightness. Only by refocusing the path of the maximum candlepower beam towards the center line of the runway, can the relatively darker area be eliminated and the path of equal brightness be restored.

Controlled-beam light projectors have been in use as contact or runway marker lights for an effective length of time to prove their success in operation. However, the installations have proved to be of considerable expense in initial construction costs and subsequent parts replacement and maintenance. In addition, these installations require elaborate control panels, which must be operated with considerable skill for maintaining the correct intensity and beam control setting. In addition, separate electrical circuits are required for separately energizing the beam-control means apart from the circuit energizing the projector lamp.

In accordance with the invention a marker light for an airport runway including a light source, variable control means for varying the current to the filament of the light source and a lens having a focusing portion for projecting a light signal emanating from said filament in a predetermined direction relative to the geometric axis of said lens is characterized in that said light source and lens are arranged for relative movement transversely of the geometric axis of the lens for projecting the light signal in a predetermined direction with respect to the runway at a predetermined filament light intensity and that control means responsive to the variations in filament current are provided to control the relative movement between said light source and lens.

It is an object of this invention to provide an improved contact or runway light projector embodying a beam control mechanism which is independent of elaborate motors, gear trains, or the like which may require considerable attention, replacement and maintenance, and further which mechanism may be readily adapted to jointly respond to the quantity of electrical energy supplied to the light source and further to move that light source with relation to the projector lens in accordance with the degree of energy supplied.

It is a further object of this invention to provide an improved contact or runway light projector in which the light source and the focal axis of the lens are movable relative to one another responsive to the quantity of energy supplied to said light source either through direct electrical connection or from emitted radiation received from said light source.

Other objects and further advantages of this invention are more fully set forth in the following description of the accompanying drawings, in which:

Fig. 1 is an elevational view, partly in section, of a dual-lens runway light utilizing a preferred embodiment of the mechanism for moving the lamp, or light source, with relation to the reflectors and/or lenses.

Fig. 2 is a top view, partly in section, of the embodiment of Fig. 1 taken on lines 2—2 of Fig. 1 with the reflectors removed to more clearly set forth the operating mechanism.

Fig. 3 is an elevational view, partly in section, of the embodiment of Fig. 1, taken on lines 3—3 of Fig. 1, and showing the relative movement of the light source with relation to the lens. The reflector elements have again been removed to clearly set forth the operating mechanism.

Fig. 4 is a diagrammatic view depicting the angular deflection of a projected light beam on movement of a light source with relation to a lens.

Figs. 5 to 9 are fragmentary views of other embodiments of the beam control mechanism arranged for actuating the light source in carrying out the present invention.

Referring now to Figs. 1, 2 and 3, the improved contact or runway marker light projector may comprise a cast housing member 1 supported by a vertical support member 2, projecting from a mounting base 3. As shown in Figs. 1 and 3, the vertical support member 2 is preferably provided with an annular breakoff groove 4, which is relatively frangible in order to shear at a relatively inexpensive portion of the projector if the projector should be accidently collided with by an approaching airplane, snowplough, or other moving object.

The lens structure 5 is mounted on the housing 1 in the usual manner. The beam-control mechanism for controlling the movement of the light source, which will hereinafter be described in detail, is readily adaptable for use in any conventional beam-control light projector. Suffice it to say for the present, that the lens structure 5 comprises a focusing portion, which includes inner and outer refracting prisms 6 and 7 respectively, a portion of which provides a "bull's-eye" focusing means.

Referring to Fig. 3, the housing 1 is provided with a maintenance-entrance door 8 pivotally mounted on trunnions 9, and engageable with the housing at its free end by means of a conventional latching clamp 10. It is preferable to position the housing 1 on a slipfitter casting 11 which will permit a convenient means for levelling the projector with reference to the runway and/or remaining projectors in a selected series. Machine screws 12 and 13 operating with relation to the fulcrum

14 may be loosened or tightened to level the projector both vertically and horizontally as will be indicated in the spirit level vial 15, shown in Fig. 2.

Line connections to the projector are made through conventional conductors 16 and 17, one of which may be grounded if so desired. The conductors are electrically connected to upright terminals 18 and 19, respectively. It will be apparent that the base 3 may be mounted directly on an individual transformer (not shown) or connected directly to multiple circuit (not shown) in the usual manner.

The beam-control mechanism, shown in Figs. 1, 2, and 3, comprises a stationary frame assembly which includes a base 20 with upwardly projecting trunnions 22 and 23 integral therewith. The frame assembly is supported by nut and stud assemblies 24, permitting the mechanism to be adjustable vertically with respect to the lens 5. The projector lamp assembly 25 is positioned in a U-shaped cradle member including a base portion 26 with supporting leg portions 27 and 28 integral therewith. The cradle assembly is pivotally supported from the trunnions 22 and 23 of the frame assembly.

A very important aspect of the present invention relates to the manner of controlling the movement of the light source with relation to the lens and/or reflectors. A preferred embodiment is shown in Figs. 1, 2 and 3; and, in fact, all of the embodiments disclosed relate to a means for moving the lamp or light source. However, it is within the scope of this invention to provide similar means for moving a lens structure or a reflector structure with relation to the light source (not shown).

With reference to Fig. 4, it will be seen diagrammatically that movement of the light source, such as the lamp 25, in a direction substantially normal to the focal axis 30 of the lens 5 will cause an angular deflection of the light beam 31 relative to the direction of movement. For instance, if the lamp 25 is moved upwardly, as shown with respect to Fig. 4, the light will be angularly deflected downwardly to the position designated by the reference character 31*a*. Accordingly, movement of the lamp 25 in a downward direction as viewed in Fig. 4 will provide an angular deflection upwardly of the light beam to the position designated as 31*b*. Obviously, similar movement of the lens 5 with respect to the light source 25 will cause a similar deflection of the light beam.

The present invention, in its preferred embodiment, contemplates the provision of a prime mover of a current-actuated bimetallic lamp actuator 35, which is caused to torsionally provide rotational motion due to its inherent ohmic resistance, The convenient bi-metallic actuator has been clearly disclosed in Figs. 1 and 2, and comprises a helically-wound bimetal strip with the high expansion metal on the outside. One end is fastened to a pivot pin 36 which projects from the support 27, and extends through an opening in the trunnion 22. The opposite end of the member 35 is fastened to the free inner end of a spirally-formed bimetallic compensator 37. The opposite end of the bimetallic compensator is securely fastened to an insulating member 38 projecting from one side of the base 20 of the frame assembly. The compensator 37 has its high expansion metal on the inside of the spiral and is provided to compensate for variations in ambient temperature affecting the actuator 35 by re-indexing the stable end of the helical actuator 35.

As has been previously stated, it has been found that the angular deflection of the beam is a function of the desired beam intensity. Accordingly, it has been found to be desirable to electrically connect the bimetallic actuator 35 in the circuit supplying current to the lamp 25. This will give a functional relationship between movement of the lamp with respect to the lens and the current supplied to the lamp. Obviously, any means for obtaining a functional relationship between the actuator and the current supply may be made with either series or parallel electrical connection, or the actuator may be supplied from a separate circuit control and remain within the broader aspects of the present invention.

As shown, a preferred method of wiring the prime mover and the lamp 25 is to connect one terminal of the lamp through a lead 39 to the upright line terminal 18. Inasmuch as relatively high operating temperatures are encountered, it has been found desirable to provide asbestos-covered leads. The opposite terminal of the lamp is connected through a lead 40 to one end of the bimetal actuator 35. As shown in Fig. 2, the lead 40 is connected at the end of the actuator terminating in the compensator 37. The opposite end of the current-responsive bimetallic actuator 35 is connected through a lead 41 to the terminal 19. A convenient and inexpensive electrical circuit may be provided with one live line connection 16 and a ground connection 17. Thus, the lead 41 need not be insulated inasmuch as it is merely a ground connection.

In order to gain full advantage of the light emanating from the lamp 25, a group of light collecting and reflecting reflectors may be provided, as shown in Fig. 1. The uppermost reflector, as viewed in Fig. 1, is composed of two portions 42 and 43 respectively. These portions have a generally concave cross section and are preferably polished to provide specular reflection of light rays which are directed upwardly from the lamp towards the lens 5. A lower reflector 44 is arranged to collect light rays which would ordinarily fall on the relatively dull, light absorbing, beam-control mechanism, and to reflect these rays towards the dual lenses positioned on either side of

the lamp 25. There is also shown a reflector 45 which may be positioned between the lamp 25 and the door 8 to reflect light away from the door surface.

Operation of the embodiment disclosed in Figs. 1, 2, and 3 is as follows:—

Assume that the projector is electrically connected as is particularly disclosed in Fig. 2. That is, with the prime mover being in series electrical connection with the lamp 25, thereby establishing a closed circuit with the terminals 18 and 19. Thus, in its preferred form, the present invention will provide an angular deflection of the light beam in the manner described with reference to Fig. 4, which deflection will be a function of the intensity of the lamp 25.

It will be apparent that the intensity of the lamp 25 will be varied in the usual manner, as for instance, with the aid of rheostats, variable reactors, and the like (not shown). Because of the series circuit connection, the energy transmitted to the lamp 25 will obviously be reflected in the prime mover circuit through the bimetallic actuator 35. Due to the inherent ohmic resistance of the actuator, the difference in the coefficient of expansion between the bimetallic layers will cause a torsional movement of the actuator. Since one end of the helical bimetal is semi-stabilized by mechanical connection with the compensator 37, the end of the actuator fastened to the pivot 36 will, therefore, be caused to rotate. This rotational motion will tend to rock the lamp cradle assembly in the direction of rotation.

In order to provide a light projector capable of operating in any locality or climate, the bimetallic compensator 37 has been provided to re-index one end of the bimetallic actuator 35 in accordance with variations in ambient temperature affecting the projector unit. A convenient compensator for the preferred helically-formed actuator 35 may be made in the form of a spiral having one end stationarily mounted with its inner or free end mechanically fastened to the actuator. Inasmuch as it is deemed preferable to provide a bimetallic actuator with the high expansion metal towards the outside, the compensator, which is not electrically connected, is arranged to oppose the motion of the actuator with the high expansion metal towards the inside.

Contact or runway marker lights are generally positioned in paired relationship with one another transversely of the runway. It is preferable to position the projector with its runway side at the top as viewed in Fig. 2. The lamp 25 will, therefore, be caused to rotate about its pivot, as shown in Fig. 3, with the runway side of the lamp being to the right as viewed therein. Thus, as electrical energy is supplied in increasing amounts to the lamp and to the prime mover, the lamp will move downwardly, as shown in Fig. 3, and in a counterclockwise manner, as illustrated by the full lines in Fig. 3. With reference to Fig. 4, it will be seen that light beams emanating from the projector will take the position designated by the reference character 31*b* as the current to the lamp and prime mover is increased. Accordingly, the companion lamp (not shown), which is positioned substantially directly opposite the described lamp will also have its beams deflected responsive to the current supplied. Obviously, the companion lamp will be positioned with its axis rotated 180° with respect to the runway and the lamp illustrated in Figs. 1, 2, and 3. However, the runway side will still be at the top as viewed in Fig. 2.

It will be apparent that under low visibility conditions, the intensity of the lamp will be increased; and in accordance with the teachings of this description, the projected light beams will be deflected to toe in with respect to the runway to provide a strong light signal which is composed of the beams emanating from the paired companion projectors.

It will be apparent that a comparative angular deflection will be made with respect to both of the dual lenses 5 where dual projection is desired. The projector will then have a two-purpose function permitting an approach from either direction of the runway in accordance with wind conditions.

Referring now to Fig. 5, which discloses another embodiment of the invention, the lamp 25 is adapted to be pivotally supported on a frame assembly similar to that of the preferred embodiment and comprising a base 20 with integrally projecting trunnions 23 on either side thereof. The lamp 25 is mounted in a generally U-shaped cradle assembly 50, and is pivotally supported on a pivot pin 51.

The prime mover of the embodiment of Fig. 5 is adapted to be actuated calorifically by the heat energy radiated by the lamp 25.

This may be conveniently accomplished in a number of ways, but it is preferable to provide a C-shaped bimetallic actuator 52, which is positioned circumjacently to the lamp envelope as shown, and in a manner that will not interfere with the major portion of the light rays emanating from the lamp filament 53. One side of the normally non-conducting actuator 52 is pivotally fastened to the cardle assembly 50 by means of a pivot pin 54. The opposite or free end of the bimetallic actuator is adapted to receive a pivot pin 55, which is jointly fastened to a bimetallic compensator member 56, where such compensator is desired. The opposite end of the compensator member is preferably stationarily mounted, as for instance, by means of a bracket 57 attached to the base 20 of the frame assembly.

It is preferable to provide a bimetallic actuator 52 that expands on heating, which will tend to draw the pivots 54 and 55 away from one another as viewed in Fig. 5. The

bimetallic compensator 56 may be provided to compensate for ambient temperature variations by re-indexing the pivot 55 responsive to such variations. The lamp 25 is operated in the position shown by the full lines under normal operating conditions. The dot-dash lines indicate the position of the lamp when no-current conditions exist, and the bimetallic actuator 52 is relatively cool. When electrical energy is supplied to the lamp 25, the lamp will emit radiant heat energy in addition to light energy. It will be apparent that the light energy and radiant heat will both be substantially proportional to the energy supplied.

Accordingly, the lamp will function as follows: As current is supplied, the lamp will be caused to move from the position shown in the dot-dash lines to the normal operating conditions shown by the full lines and continue to rotate in a clockwise manner (not shown) about the pivot 51, responsive to the amount of energy supplied.

A further embodiment of the present invention has been disclosed in Fig. 6. In this embodiment the lamp 25 is again pivotally actuated by means of a prime mover, which is conjointly energized by the circuit supplying the lamp. However, in this case the prime mover takes the form of a compensated bimetal actuated by means of an independently energized heater coil. The lamp 25 is positioned on a cradle assembly 60 which is pivotally mounted on a pivot pin 61 positioned in a trunnion 62 integral with a frame assembly base 63.

The prime mover comprises an S-shaped two-portion bimetal actuator 64. The actuator 64 comprises a U-shaped actuating portion 65 having its high-expansion metal towards the outer side, and which is integrally fastened to a compensator portion 66 having its high-expansion surface towards the inner side. The opposite end of the compensator portion is stationarily fastened by means of a bracket 67 to the base 63 of the frame assembly. The free end of the actuating portion 65 is arranged to engage an adjustable bolt and nut assembly 68, which is adapted to engage a threaded opening in the cradle assembly 60.

The actuating portion 65 of the prime mover is arranged to be thermally responsive to electrical energy supplied to a heater coil 69 which is preferably wound circumjacent thereto, although the coil may be positioned in any convenient manner whereby calorific energy may be conducted to the actuating portion 65. As shown in Fig. 6, the heater coil is electrically connected through a lead 70 to the lamp filament 71 to provide a series electrical connection. However, it will be apparent that the heater coil may be independently actuated by a separate pilot control circuit, if so desired. In addition, a parallel electrical circuit (not shown), may be connected in accordance with a feature of the invention.

Thus, the embodiment of Fig. 6 is provided with a prime mover that permits the lamp to rotate about its pivot 61 when the actuator 64 is expanded by the heater coil 69. The degree of rotation with respect to the movement of the bimetal may be adjusted by means of the nut and bolt assembly 68. As stated above, the actuator portion 65 of the actuator is compensated for variations in ambient temperature by means of the compensator portion 66 integral therewith. As energy is supplied to the heater coil 69 the actuating portion 65 tends to rise and carry with it the cradle assembly 60 to tilt the lamp to the position shown in the dot-dash lines.

Fig. 7 is illustrative of still another embodiment of the present invention, and relates to a bellows-operated prime mover for the projector lamp 25. The lamp assembly may take substantially the same form as disclosed in Fig. 6. Like parts are accordingly numbered with like reference characters.

A lamp 25 is mounted on a movable cradle assembly 60 which is pivotally positioned on a pivot 61, which is supported by the trunnions 62 projecting upwardly from the base portion 63 of the frame assembly. In this case a vapour-actuated expansible bellows member 73 is provided as a prime mover, and is arranged to engage with the adjustable nut and bolt assembly 68 positioned on the cradle assembly 60. The bellows are formed of a flexible material and may be made expansibly responsive to thermal energy transmitted through a heater coil 74 contained therein. The bellows may be filled or partially filled with a vaporous liquid (not shown), or may be entirely gas-filled. It will be apparent that as energy is supplied by the heater coil 74, the fluid contained in the bellows will be caused to expand on heating, thus forcing the bellows to move upwardly towards engagement with the nut and bolt assembly 68. The consequent rotation of the lamp 25 about its pivot point 61 may thus be made responsive to the degree of expansion of the bellows members 73 reflective of energy supplied to the heater coil 74. Other means of supplying heat energy to the bellows will be apparent, though not shown.

The embodiments of Figs. 8 and 9 relate to electro-magnetic devices for actuating the movement of the lamp structure 25. As shown in Fig. 8, the lamp is mounted to move conjointly with the armature 80 of a rotary solenoid. The solenoid further comprises a core member 81 having a coil 82 wound on one leg thereof. A counterbalanced pendulum 83 is preferably provided for the lamp 25. The pendulum 83 is preferably of an adjustable type for changing the center of gravity according to given conditions.

As viewed in Fig. 8, the coil 82 of the solenoid is connected in series with the filament

84 of the lamp 25, but it is understood that the coil may be independently connected to a pilot circuit if so desired. It is within the broad aspects of the invention to include any type of a solenoid arrangement for actuating the movement of the lamp.

Fig. 9 discloses another variation of an electromagnetic prime mover, which is based on the D'Arsonval principle of operation and comprises an actuator which is substantially identical to a conventional ammeter of the moving-coil variety.

As disclosed, the embodiment of Fig. 9 incorporates a projector lamp 25 adapted to be actuated responsive to the rotational movement of the projecting pivoted arm 90, which is mounted on a pivot pin 91. The pivot pin and arm are actuated by the motion of a torsional spring 92 connected with a moving coil 93 wound longitudinally of the axis of the armature 94. The electromagnetic field is provided by a magnetic core member 95.

A preferable method of electrically connecting the prime mover of the lamp is by means of a flexible lead 96 connected to the lamp circuit through the torsional spring 92, and from the moving coil 93 through a lead 97 to a shunt resistor 98. A lead 99 connects the lamp filament to the opposite side of the shunt 98. Line connections may be made on either side of this resistor by means of leads 100 and 101. The resistor 98 may be of the usual type provided for protecting ammeters that are subjected to relatively heavy line currents.

It will be apparent that the movement of the lamp from the position shown in the full lines to that shown in the dot-dash lines will be directly responsive to current supplied to the ammeter-type device. If it is so desired, the connection may be made through a separate control circuit.

Although the light source has been shown as a lamp mounted on a pivotably movable structure, it will be apparent that the various embodiments of the control mechanism are each readily adaptable for providing movement of the lamp with respect to the lens in any of various other ways. Lateral movement of the lamp (not shown) may be had through linkages, gear trains, etc., without requiring extensive modification of the lamp components hereinabove described.

Moreover, it is to be understood that the lens could be moved relative to the lamp or both lens and lamp could be moved by the actuator.

WHAT WE CLAIM IS:—

1. A marker light for an airport runway including a light source, variable control means for varying the current to the filament of the light source and a lens having a focusing portion for projecting a light signal emanating from said filament in a predetermined direction relative to the geometric axis of said lens, characterized in that said light source and lens are arranged for relative movement transversely of the geometric axis of the lens for projecting the light signal in a predetermined direction with respect to the runway at a predetermined filament light intensity and that control means responsive to the variations in filament current are provided to control the relative movement between said light source and lens.

2. A marker light for an airport runway in accordance with claim 1, characterized in that said light source is movable transversely of said geometric axis and that said control means control the transverse movement of the light source.

3. A marker light for an airport runway in accordance with claim 1 or 2, characterized in that said control means are in electrical connection with the filament.

4. A marker light for an airport runway in accordance with claim 1, 2 or 3, characterized in that said control means include a bi-metallic actuator.

5. A marker light for an airport runway in accordance with claim 4, characterized by an ambient temperature compensator for said actuator.

6. A marker light for an airport runway in accordance with claim 4, characterized in that said bimetallic actuator is arranged to translate electric energy supplied thereto into mechanical motion by means of its ohmic resistance.

7. A marker light for an airport runway in accordance with claim 5, characterized in that said control means include the bi-metallic element of said actuator and an electric heater coil for thermally actuating said bimetallic element.

8. A marker light for an airport runway in accordance with claim 1 or 2, characterized in that said control means include a prime mover operatively related to said light source and lens and responsive to variations in filament current and an ambient temperature compensator for said prime mover.

9. A marker light for an airport runway in accordance with claim 1 or 2, characterized in that said control means include a prime mover for moving said light source comprising a bimetallic element arranged to translate electric energy into mechanical motion by means of its inherent ohmic resistance and responsive to variations in current in said filament for controlling said relative movement, and an ambient temperature compensator for said prime mover.

10. A marker light for an airport runway in accordance with claim 1, characterized in that said control means include an actuator operated under the influence of a thermally expansible fluid, associated therewith and arranged to translate calorific energy into mechanical motion on thermal expansion of said fluid.

11. A marker light for an airport runway in accordance with claim 10, characterized by a bellows member containing said fluid.

12. A marker light for an airport runway in accordance with claim 10 or 11, characterized in that said control means include an electric heater coil in electrical connection with said filament for effecting thermal expansion of said fluid.

13. A marker light for an airport runway in accordance with claim 1 or 2, characterized in that said control means include an electromagnetic actuator operatively related to said light source and/or said lens responsive to variations in current in said filament for controlling transverse movement of said light source and/or lens.

14. A marker light for an airport runway in accordance with claim 1 or 2, characterized in that said control means include a prime mover comprising an electrically actuated helically formed bi-metallic element adapted to provide torsional movement on heating due to its ohmic resistance and in electrical connection with said filament for controlling said relative movement and an ambient temperature compensating bi-metallic element associated with said helically formed bimetallic element.

15. A marker light for an airport runway substantially as herein described.

16. A marker light for an airport runway substantially as described and as illustrated in Figs. 1 to 3 or any one of Figs. 5 to 9 of the accompanying drawings.

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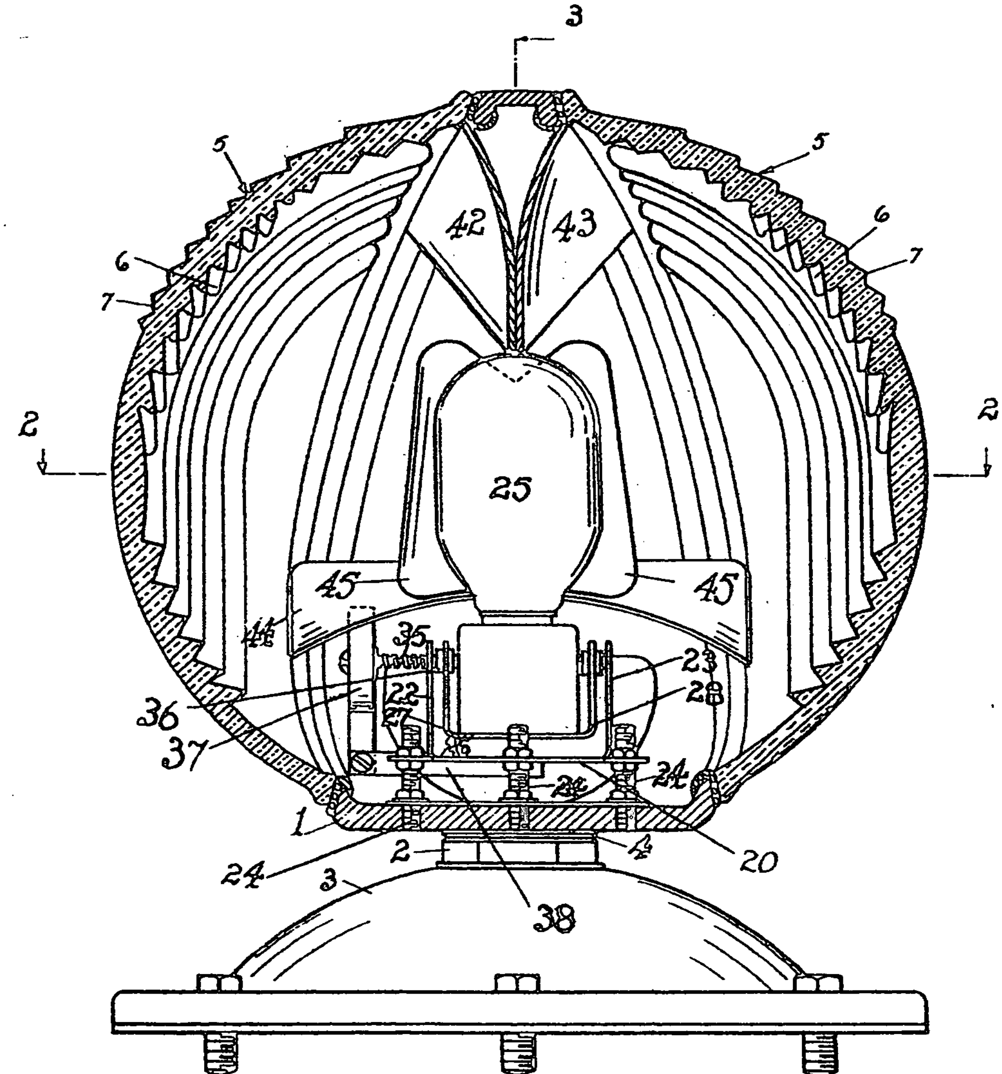
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Fig. 1

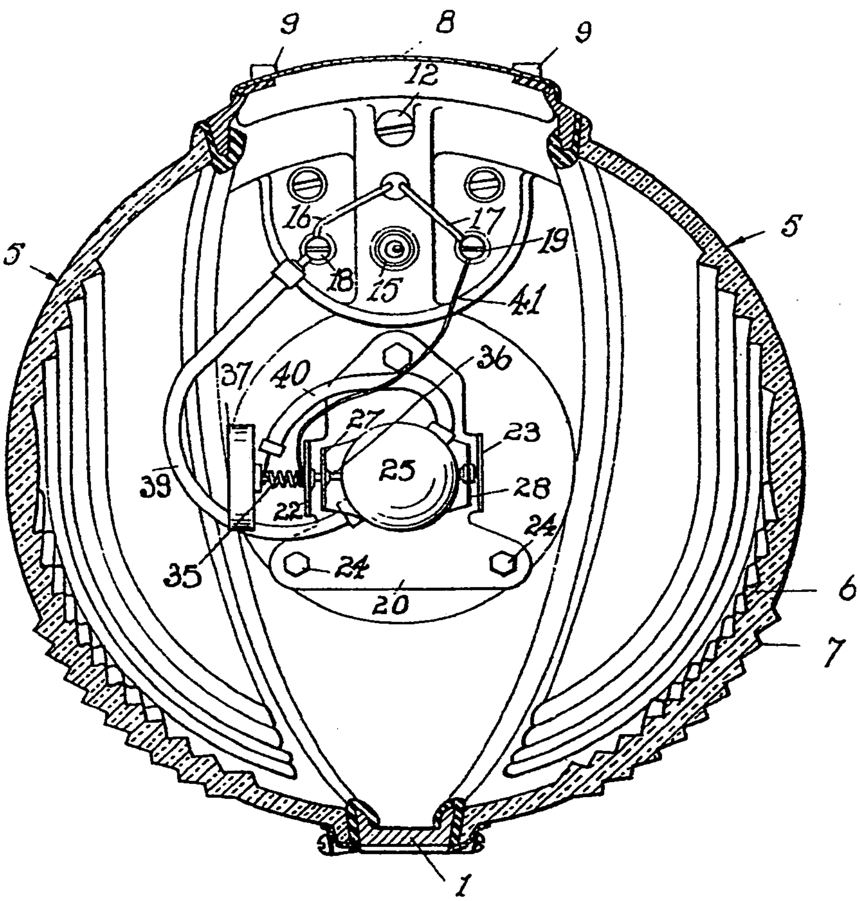

Fig. 2

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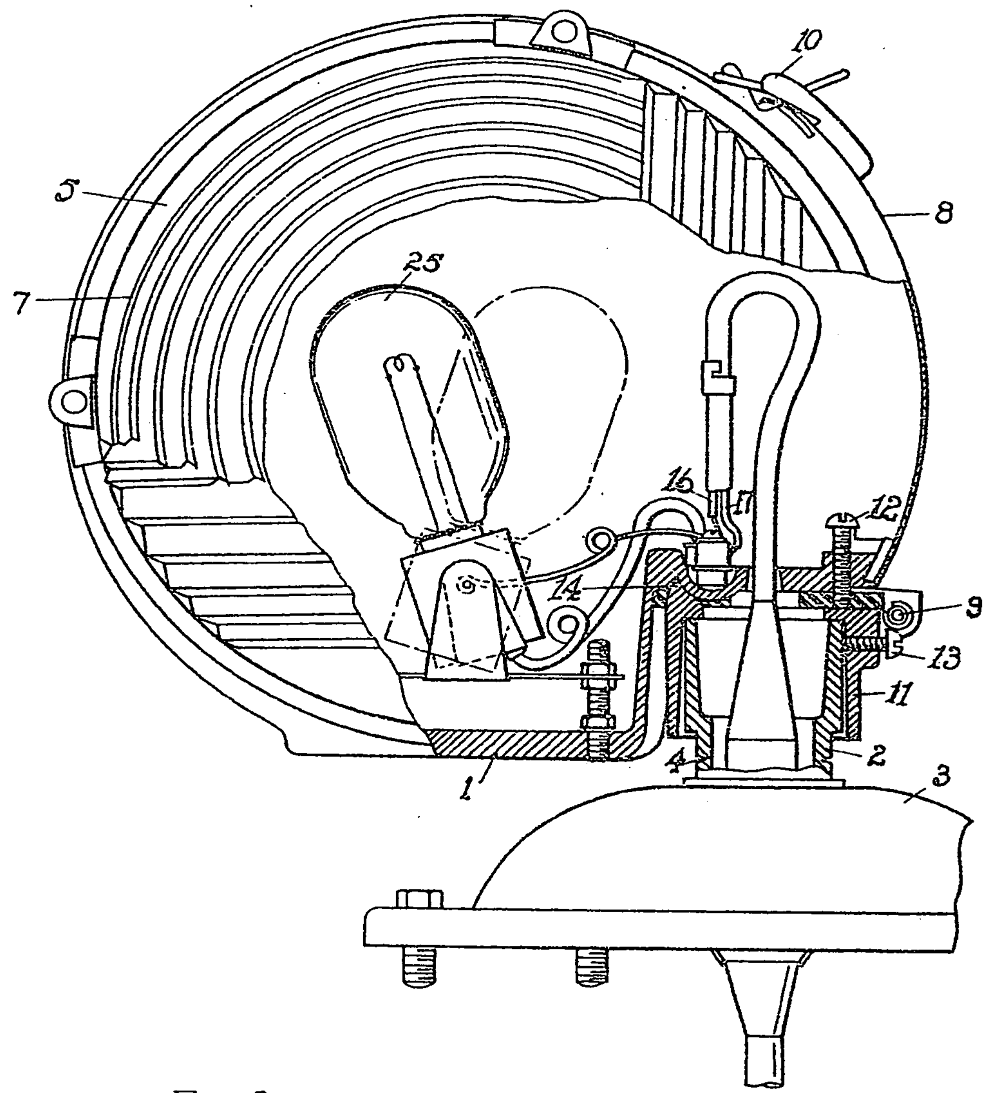

Fig. 3

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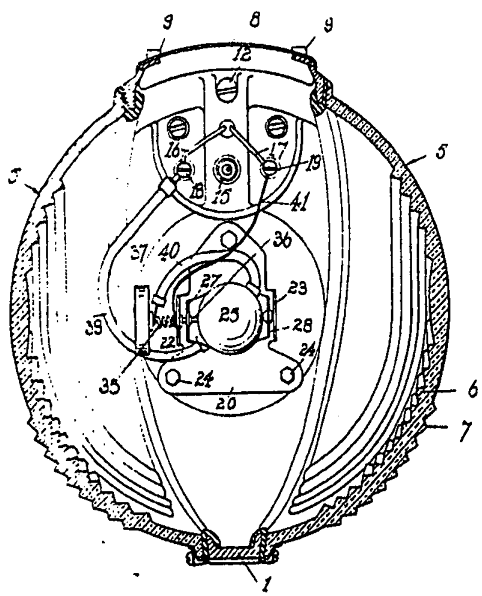

Fig. 2

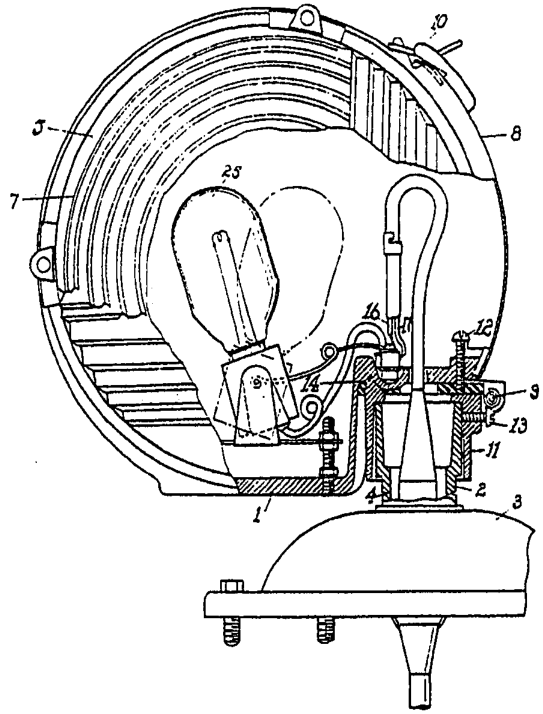

Fig. 3